Title: What's Your Poison?

Brief Overview:

On an expedition to the rainforest, students will gather and organize data on the population of frogs. Students will also experiment with probability. This learning unit, which can be integrated into a social studies or science curriculum, involves collecting, organizing, displaying, and analyzing data.

Links to NCTM Standards:

- **Mathematics as Problem Solving**
  Students will demonstrate their ability to solve problems in mathematics including problems with open-ended answers, problems which are solved in a cooperative atmosphere, and problems which are solved with the use of technology.

- **Mathematics as Communication**
  Students will demonstrate their ability to communicate mathematically. They will read, write, and discuss mathematics with language and the signs, symbols, and terms of the discipline.

- **Mathematics as Reasoning**
  Students will demonstrate their ability to reason mathematically. They will make conjectures, gather evidence, and build arguments.

- **Mathematical Connections**
  Students will demonstrate their ability to connect mathematics topics within the discipline and with other disciplines.

- **Whole Number Computation and Estimation**
  Students will demonstrate their ability to apply estimation strategies in computation and in problem solving. They will determine the reasonableness of solutions.

- **Number Sense and Numeration**
  Students will demonstrate their ability to describe and apply number relationships using concrete and abstract materials. They will choose appropriate operations and describe effects of operations on numbers.

- **Statistics and Probability**
  Students will demonstrate their ability to collect, organize, and display data and will interpret information obtained from displays. They will demonstrate the basic concepts of probability such as predicting and finding probabilities. Students will write a creative story based on statistical information.

Grade/Level:

Grades 3-4

Duration/Length:

This unit takes approximately 3-4 class periods (50 minutes each) to complete.

Prerequisite Knowledge:

Students should have working knowledge of the following:

- Estimating and predicting
- Using a calculator
- Constructing and labeling a frequency chart and bar graph
- Experimenting with probability
- Interpreting and analyzing data
- Writing to express personal ideas

Objectives:

Students will:

- collect, organize, interpret, analyze and display data.
- work cooperatively in pairs.
- experiment with probability.
- communicate mathematical data through creative writing.

Materials/Resources/Printed Materials:

- Teacher Resource 1 (What's Your Poison? Vignette #1)
- Teacher Resource 2 (What's Your Poison? Vignette #2)
- Teacher Resource 3 (Writing for Personal Expression Prompt)
- Teacher Resource 4 (Rubric for Writing Prompt)
- Student Resource 1 (Frog Population)
- Student Resource 2 (Frog Random Sample Data Sheet)
- Graph paper
- Student calculators
- Student Resource 3 (Probability Data Sheet)
- Small brown paper bag per pair of students
- Unifix Cubes (10 yellow, 2 red) per pair of students
- Tuesday by David Wiesner
- http://members.tripod.com/~Dendrobates/index.html (Teacher Website)
- www.icon.portland.or.us/education/vose/kidopedia/poison.html (Student Website)

Development/Procedures:

Day 1:

- Create a KWL about rainforest frogs. (What you **KNOW**, What you **WANT** to know, and What you have **LEARNED**).
- Explain to the students that they will conduct a simulation to research and compile data on the population of rainforest frogs.
- Organize students into pairs and discuss the vignette.
- Distribute Student Resource 1. Explain to the children that the handout represents the frog population in the rainforest. Do not let the students count the number of frogs in their population.
- Distribute Student Resource 2. Tell the students to look at their frog population. Tell the pairs of students to predict how many frogs they think are in their population. Have the students write their predictions on Student Resource 2.

- Instruct the students to take a random sampling of their frog population. Cut out the one inch square of paper from Student Resource. Hold the square above the frog population handout. Drop the square and allow it to land anywhere on the handout. Look through the square paper and count the number of frogs covered. The covered frogs represent the Population Sample.
- Tell the students to take five random samples and to record their data on Student Resource 2. Calculate the Sample Total and the Average and record on data sheet.
- Tell the students to look at Student Resource 1 again. Show them how they can calculate the square units. (Note: You will see tick marks around the outside of the frog picture: 7 X 10 = 70 square units).
- Tell the students to multiply their average by the number of square units to calculate and record the Population Estimate. At this point, you will tell the students the Actual Population 223 or have the students count the frogs themselves. Students will calculate the Difference between their Population Estimate and the Actual Population.
- Students should analyze their data in the space provided on Student Resource 2.
- Allow the pairs to share their data with the class. Discuss the class findings.
- Were Population Estimate totals similar throughout the class?
- What are the benefits of taking a random sample?
- Based on your prediction were the results what you expected?

Day 2:

- Review Student Resources 1 and 2, discuss the data findings about the frog population numbers in the rainforest, and especially note the difference in the type of frogs represented. The discussion should lead to the fact that there are poisonous frogs (small frog) as well as nonpoisonous frogs (large frog). Today students will experiment to determine the probability of finding a poisonous frog on their expedition in the rainforest.
- Organize students into pairs, and supply each pair with a bag containing 12 Unifix Cubes. (10 yellow and 2 red: The cubes represent poisonous (red) and nonpoisonous (yellow) frogs.) Tell students there are 12 cubes in the bag, but DO NOT tell how many of each color.
- Based on the discussion and observation of Student Resources 1 and 2, students should record a prediction about the likelihood of drawing a "poisonous" frog from the bag on Student Resource 3. Students should write using probability language: certain, likely, unlikely, impossible. Then each team will simulate finding frogs on a hike in the rainforest by drawing cubes from the bag. Draw one cube at a time and replace it into the bag. After each event, the students should record their outcomes. Repeat this procedure 24 more times for a total of 25. Calculate totals for each color.
- Teacher will collect the totals from each pair and record the numbers on the board. Students will then organize that data and construct a bar graph showing the number of "poisonous" and "nonpoisonous" frogs. (Note: Teacher may want to guide students to select a scale that will facilitate ease of displaying the large numbers on the bar graph.)
- Discuss the results of the data collections.
- Were individual predictions close to the actual results?
- What is the probability of finding a nonpoisonous frog on a hike? . . . a poisonous frog? How does your individual data compare with the group data?
- Why is it more valid to look at group data when discussing probability?
- Based on the individual and group data, students will reflect on this activity by writing a paragraph to interpret and analyze the data and evaluate their predictions on Student Resource 3.

Day 3:

- Review the class findings about rainforest frogs from days 1 and 2 through discussion.
- Read Vignette #2.
- Display a copy of the writing prompt and the rubric.
- Read/discuss the book Tuesday by David Wiesner as a motivator for the writing prompt.
- Students organize their ideas for the writing prompt by completing a prewriting graphic organizer of their choice.

Performance Assessment:

Students will complete the Writing for Personal Expression Writing Prompt. The scoring rubric is found on Teacher Resource 4.

Extension/Follow Up:

- Use the Internet or media center to investigate actual frog populations in the rainforest to compare with simulated data.
- Write a research report on a rainforest frog.
- Create a scatter plot to depict the distance students can jump related to their height or weight.
- Observe the life cycle of a frog by raising tadpoles in the classroom.

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What's Your Poison?

Vignette #1

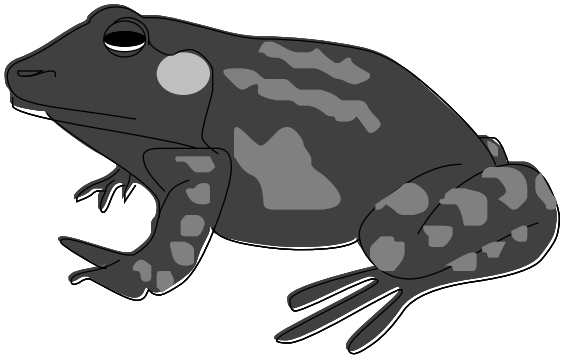
Our class has been studying the rainforest. Since we have learned a tremendous amount about the climate, the plant life, and the animals; the Rainforest Action Network (RAN) has asked for our assistance. They have decided to fund an expedition for us to gather data in the Costa Rican rainforest. After school today, we will need to go to our homes and pack our suitcases. What kind of things will we need to take? Our flight will be taking off tomorrow morning at 6:00 a.m. Who can predict what time we will be landing in Costa Rica?

Welcome to Costa Rica! We have just unpacked our suitcases, and we meet our RAN lead scientist. She tells us our mission which is to discover data on the frogs of the rainforest. We will need to collect, interpret and analyze data on the frog population. Remember to keep your data in a safe place.

What's Your Poison?

Vignette #2

We have just returned from our expedition to the Costa Rican rainforest. We have collected, interpreted and analyzed our data on the frog population we found there. However, I have just received a very disturbing phone call from RAN. The scientists from RAN decided to take another random sampling of the frog population to make sure our data was accurate. However, they have just recorded a frog population much lower than the data we gave them. Someone in this room must have secretly brought back a couple of rainforest frogs in his or her suitcase! The scientists from RAN are very concerned because the frogs that are missing are famous for their rapid reproduction.



What's Your Poison?

Writing for Personal Expression

In Anyplace, USA, a strange and curious event occurred. Out of nowhere, thousands of frogs appeared. They were everywhere . . . in houses, on playgrounds, in the air and on the ground.

What would your community be like if a similar event happened where you lived? Write a story, poem or play describing the event. Remember to use what you have learned about the rainforest, the sample population and probability in your writing.

What's Your Poison?

Rubric for Personal Expression

3 Points:

- Writing is clear and organized.
- Includes 3 probability and/or random sampling details.
- Demonstrates substantial understanding of data analysis.
- Few grammar, spelling, or punctuation errors.

2 Points:

- Writing is somewhat clear and well-organized.
- Includes 2 probability and/or random sampling details.
- Demonstrates partial understanding of data analysis.
- Some grammar, spelling, or punctuation errors.

1 Point:

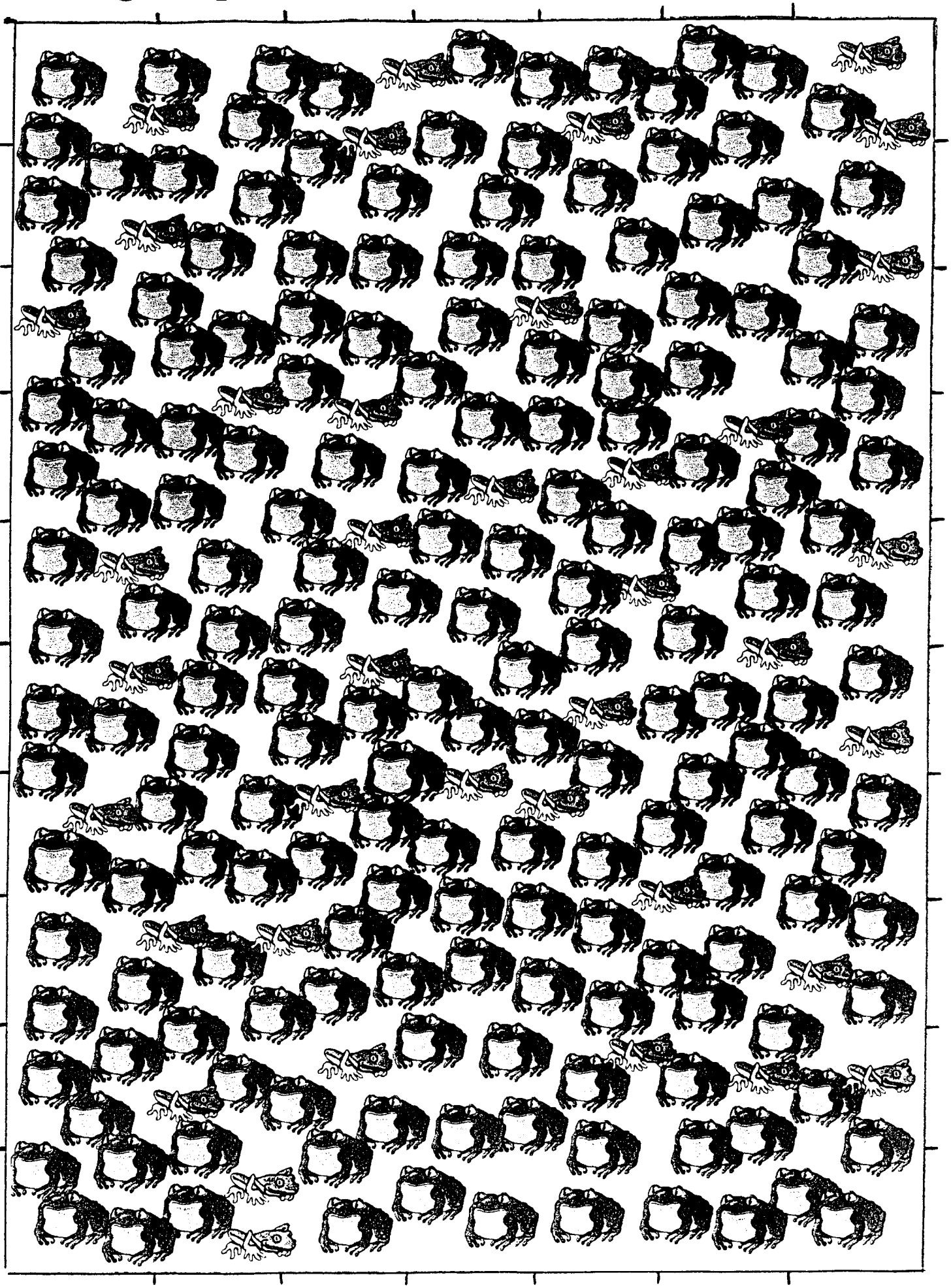
- Writing is vague.
- Includes 1 probability and/or random sampling details.
- Demonstrates little understanding of data analysis.
- Many grammar, spelling, or punctuation errors.

0 Points:

- No response given.

Frog Population

Student Resource 1



Random Sample Data Sheet

Predict how many frogs are in the frog population. _____

Record 5 random samples.

A _____

B _____

C _____

D _____

E _____

Calculate the Sample Total....._____

Calculate the Average....._____

Multiply by the number of square units....._____

Record the Population Estimate....._____

Record the Actual Population....._____

Calculate the Difference....._____

Reflection: Write 3-5 sentences to interpret and analyze your data.

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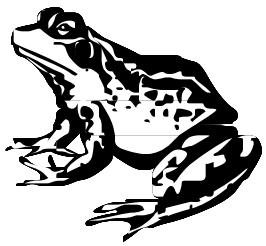

CUT OUT

Poisonous or Nonpoisonous ?

Probability Data Collection

Predict: Based on your random sample of frogs located in the rainforest, predict the probability of observing a poisonous frog on your hike in the rainforest.

_____

_____

_____

Conduct a simulation: Tally the results of your probability experiment.

Kind of Frog	Tally	Total

Reflection: Write a paragraph to evaluate your prediction. Interpret and analyze the probability data displayed on your graph.

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